MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

HCB1011 – CELL BIOLOGY

(All sections / Groups)

24 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **4** pages with **5** Questions only.
2. Answer **ALL THE QUESTIONS**. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers **clearly** and **neatly** in the Answer Booklet provided.

QUESTION 1

(a) Stanley Miller and Harold Urey recreated Earth's early atmosphere in a test tube. Then they bombarded the chemical mixture with ultraviolet light and simulated lightning. What were the results? What do the results imply about the origin of life? [2 marks]

(b) What were the most likely first living cells on Earth? Explain your answer. [2 marks]

(c) Macrophages are cells in the human immune system whose job is to take in and then break down potentially harmful materials like germs and cancer cells. Which organelle below would you expect to find in abundance in macrophages? [0.5m]

(d) Muscle cells have special fibers that use ATP to slide across each other to allow muscle contraction and, thereby, movement. Which organelle below would you expect to find in abundance in muscle cells. [0.5m]

(e) Name TWO differences between prokaryotic and eukaryotic genomes. [2 marks]

(f) What cell structures do prokaryotes and eukaryotes have in common? Name FOUR. [2 marks]

(g) How do prokaryotes make ATP without mitochondria? [1 mark]

QUESTION 2

(a) Why was Rosalind Franklin's X-ray diffraction picture of DNA so important? [1 mark]

(b) Why does DNA replication occur in the 5' to 3' direction? [1 mark]

(c) What are the FOUR steps of DNA replication in the cell? [2 marks]

(d) Why does DNA replication need to be accurate? How do cells ensure that DNA replication is accurate? [2 marks]

(e) What is a TATA box? What is its function? [2 marks]

(f) What is the advantage of the 5 cap and poly(A) tail? [2 marks]

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QUESTION 3

(a) How does translation differ in prokaryotes and eukaryotes? [1 mark]

(b) There is a single open-reading from (ORF) in the DNA molecule shown below. Find the ORF in one of the DNA strands. (Recall that an ORF begins with a start codon and ends with a stop codon).

5'-CGATCGCTATAAGGTTGACCTAGAGTTCGATTTACTCGTTTATGTGGCAGGCCATTTCTAAA-3'
3'-GCTAGCGATATTCCAACTGGATCTCAAGCTAAATGAGCAAATACACCGTCCGGTAAAGATTT-5'

i. Write the mRNA sequence derived from this ORF. [2 marks]

ii. Using the codon chart provided below, translate the mRNA into a protein sequence. Write the protein sequence using single-letter abbreviation for the amino acid residues. [2 marks]

--- CODON CHART ---

1st letter	Second Letter: U	Second Letter: C	Second Letter: A	Second Letter: G	3rd letter
U	UUU Phe, UUC Phe, UUA Leu, UUG Leu	UCU Ser, UCC Ser, UCA Ser, UCG Ser	UAU Tyr, UAC Tyr, UAA Stop, UAG Stop	UGU Cys, UGC Cys, UGA Stop, UGG Trp	U C A G
C	CUU Leu, CUC Leu, CUA Leu, CUG Leu	CCU Pro, CCC Pro, CCA Pro, CCG Pro	CAU His, CAC His, CAA Gln, CAG Gln	CGU Arg, CGC Arg, CGA Arg, CGG Arg	U C A G
A	AUU Ile, AUC Ile, AUA Ile, AUG Met	ACU Thr, ACC Thr, ACA Thr, ACG Thr	AAU Asn, AAC Asn, AAA Lys, AAG Lys	AGU Ser, AGC Ser, AGA Arg, AGG Arg	U C A G
G	GUU Val, GUC Val, GUA Val, GUG Val	GCU Ala, GCC Ala, GCA Ala, GCG Ala	GAU Asp, GAC Asp, GAA Glu, GAG Glu	GGU Gly, GGC Gly, GGA Gly, GGG Gly	U C A G

Key:

Ala = Alanine (A)
Arg = Arginine (R)
Asn = Asparagine (N)
Asp = Aspartate (D)
Cys = Cysteine (C)
Gln = Glutamine (Q)
Glu = Glutamate (E)
Gly = Glycine (G)
His = Histidine (H)
Ile = Isoleucine (I)
Leu = Leucine (L)
Lys = Lysine (K)
Met = Methionine (M)
Phe = Phenylalanine (F)
Pro = Proline (P)
Ser = Serine (S)
Thr = Threonine (T)
Trp = Tryptophan (W)
Tyr = Tyrosine (Y)
Val = Valine (V)

(c) What is the extracellular matrix (ECM) made up of? What is the function of ECM? [2 marks]

(d) What are the THREE types of intercellular junction? What are their roles? [3 marks]

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QUESTION 4

(a) Stem cell research has come a long way over the last few decades with many new exciting potential healthcare applications being developed.

i. What is stem cell therapy? [1 mark]

ii. Name TWO defining characteristics of a stem cell. [1 mark]

iii. Where do stem cells come from for stem cell therapy? [2 marks]

iv. Several issues have been raised about the ethics of embryonic stem cell research. Why can't researchers use adult stem cells instead? [2 marks]

(b) Cell signaling is a complex system of communication between the cells to regulate cellular activities. With the help of simple diagrams, describe the FOUR forms of chemical signaling. [4 marks]

QUESTION 5

Answer TRUE or FALSE for each of the statements below. If the statement is FALSE, correct the statement. [10 marks]

(a) Mendel developed the theory of natural selection in the 1800's.

(b) Nucleus is the control centre of the cell while nucleolus is the control centre of the nucleus.

(c) Ribosomes are small particles which are found individually in the cytoplasm and also line the membranes of the golgi apparatus.

(d) Both animal cells and plant cells have centrioles, ribosomes, and mitochondria.

(e) Facilitated diffusion involves the passage of molecules across a cell wall with the help of specific transport proteins, requiring no energy.

(f) In most eukaryotic genes, coding regions (exons) are interrupted by noncoding regions (introns).

(g) Paternal and maternal haploid genomes unite during meiosis to restore full chromosome number.

(h) Nucleoid is the region in a prokaryotic cell where DNA is double-stranded and generally take a liner form.

(i) Cells have the same DNA but different appearances because different genes are active in different cells.

(j) Transfer RNA (tRNA) is the type of RNA molecule that transfer polypeptides to ribosomes to make proteins.

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